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GEORGIA INSTITUTE OF TECHNOLOGY
Engineering Experiment Station

**PROJECT INITIATION**

Date: January 4, 1974

Project Title: Preliminary Study of Truss Plate and Floor Truss Designs

Project No.: A-1579

Project Director: Mr. J. M. Akridge

Sponsor: The Sanford Company, Inc., Peachtree City, Georgia

Effective: 12-1-73 Estimated to run until: 1-31-74

Type Agreement: Standard Industrial dated 11-6-73 Amount: $ 2,500.00

REPORTS REQUIRED: Phase I Summary Report

SPONSOR CONTACT PERSON: Mr. Charles D. Flynn
Division Manager
The Sanford Company, Inc.
Georgia Division
P.O. Box 2015
Peachtree City, Georgia 30269

Phone: 404 461-8191

Assigned to SENSOR SYSTEMS Division

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# GEORGIA INSTITUTE OF TECHNOLOGY
## Engineering Experiment Station

### PROJECT TERMINATION

Date January 8, 1975

PROJECT TITLE: Preliminary Study of Truss Plate and Floor Truss Designs

PROJECT NO: A-1579

PROJECT DIRECTOR: Mr. J. M. Akridge

SPONSOR: The Sanford Company, Inc.; Peachtree City, Ga.

TERMINATION EFFECTIVE: Mar. 8, 1974 (Phase I Final Report submitted)

CHARGES SHOULD CLEAR ACCOUNTING BY: N/A - all charges billed & paid

CONTRACT CLOSEOUT ITEMS REMAINING: Return $1,000 advance payment to Sponsor:

The Sanford Company, Inc.
Attn: Mr. Richard Harless
P.O. Box 399
Vernon, Ala. 35592

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Form EES 402 (R10-62)

A-1579

ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

January 29, 1974

The Sanford Company, Inc.
P. O. Box 2015
Peachtree City, Georgia 30269

Attention: Mr. Charles D. Flynn

Subject: "Preliminary Study of Truss Plate and Floor Truss Designs" (EES Project A-1579) Phase I Interim Report

Dear Sir:

The literature has been extensively searched with emphasis on test work which defines the mode of failure for truss plates. Failure usually occurs in one of the following four modes:

1. Tensile failure of the plate - this is usually caused by too much area being removed from the plate cross-section to form teeth.

2. Shear failure of the plate - this can be caused by too much area being removed from the plate cross-section to form teeth, as well as by poor orientation of the teeth.

3. Shear failure of the teeth - this is usually caused by having too few teeth, or by improper tooth design.

4. Failure of teeth to remain embedded in the plate - this can be caused by having too few teeth, improper tooth design, or poor tooth orientation.

The patent search is nearly complete on the truss plates, and well under way on the tension member. A review of over eighty truss-plate patents reveals that there are often only minor differences in tooth design between one existing patent and another. Thus, in our opinion, the probability that a relatively minor change in tooth design would qualify for a new patent is good. The patent coverage on the original concept expired many years ago. This suggests that we are only limited by our originality and willingness to test several designs to determine which should be patented and marketed. We must keep in mind that new designs should differ in detail from any previously patented.

The patent search on the tension member has not progressed sufficiently far to make possible any generalities at present. We have conducted stress analysis of several trusses using the wire concept first suggested by you. These analyses show the concept for symmetrically loaded, end-supported beams to be good, with only the question of how to pretension the wires still unanswered. Unfortunately, if the beam is not symmetrically loaded or is cantilevered or has an auxiliary support added, the load diagram can change

sufficiently to place the "tension" member into compression. Since wires are unable to carry compressive loads, the beam would fail.

The work on Phase I should be completed by 15 February and you should have the Summary Report giving final results and recommendations by 22 February.

Very truly yours,

James M. Akridge
Project Director

JA/psd

ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

1 March 1974

The Sanford Company, Inc.
P. O. Box 399
Vernon, Alabama 35592

Attention: Mr. Richard Harless

Subject: Phase I Final Report on "Preliminary Study of Truss Plate and Floor Truss Designs" (EES/GIT Project A-1579)

Dear Sir:

The literature has been extensively searched for patents relating to both truss plates and tension members. This search indicates the following:

1. The original sheet-metal truss-plate patent expired many years ago.

2. Sheet-metal truss-plate patents that are still in effect differ in many instances only in minor details of design features such as the shape, orientation, stiffening, and density of the teeth. (Note there are well over 50 sheet-metal truss-plate patents still in effect.)

3. Sheet-metal truss plates in general fall into one of three categories (all related to the method in which the plate is inserted).

   a) ROLL-INSERTED PLATES - The Sanford Industries plate (Patent No. 3,377,905) is representative of this type of plate. These are characterized by considerably shorter teeth, by greater tooth density, and by special tooth orientation designed to reduce tooth bending while the plate is being rolled into the wood.

   b) PRESS-INSERTED PLATES - The Hydro-Air Engineering plate (Patent No. 3,241,424) is representative of this type of plate. These are characterized by longer teeth, by lower tooth density, and by teeth frequently oriented in several different planes.

c) MANUALLY INSERTED PLATES - The "Panel Clip" plate (Patent Pending) is representative of this type of plate. These plates are characterized by bent teeth protruding from the back surface of the plate and a smooth surface on the wood side. This permits the plate to be hammered into position without badly deforming the plate.

4. Metal-tension members for wooden trusses have also been in use for many years; present patents are primarily devoted to some unique method of attaching the metal members to the wooden ones.

5. The Sanford Industries metal-tension members (Patent No. 3,416,283) appears to be unique only in that it uses punched holes in each end through which the truss-plate teeth can be positioned, allowing the tension-member-truss-plate combination to be attached to the wooden members.

6. In our opinion, it is both feasible and practical to design truss plate and tension members which do not infringe on existing patents.

Before a truss plate is designed, it is important to understand where failure usually occurs and why. Phase I also covered this aspect of the plate design. Failure usually occurs in one of the following four modes:

1. Tensile failure of the plate - This is usually caused by removal of too much area from the plate cross-section to form teeth.

2. Shear failure of the plate - This is usually caused by removal of too much area to form teeth, by poor tooth orientation, or by improper tooth positioning.

3. Shear failure of the teeth - This is usually caused by having too few teeth, or by improper tooth design.

4. Failure of teeth to remain embedded in the plate - This can be caused by too few teeth, improper tooth design, or by poor tooth orientation.

In addition to the failure consideration in plate design, the following factors must also be considered:

1. The plate must be relatively economical to manufacture.

2. Ideally, the plate should be designed for one method of insertion, i.e., roll, press, or manual.

3. If the plate is to be used with a metal-tension member, consideration should be given to a combination function, i.e., using the truss plate to attach the tension member.

4. Consideration should also be given to positioning the plate before roll insertion. (The present method of partially hammering in the teeth leaves much to be desired.)

Similar consideration should also be given to design of the metal-tension member. Stress analysis of several trusses using the wire concept first suggested by Charles Flynn revealed the concept to be good for symmetrically loaded, end-supported beams, only the question of pretension being unresolved. The analysis revealed that if the beam is not symmetrically loaded, is cantilevered or has an auxiliary support, the loading can change sufficiently to place the "tension" member into compressions. Since the wires are unable to carry compressive loads, the beam may fail.

To summarize, in our opinion, the probability is good that both a truss plate and a metal-tension member can be designed that will perform well and will not infringe on other patents. Since the coverage of most patents for truss plates and metal-tension members is narrow, we are limited only by our desire and originality. We must keep in mind that, to be patentable, new designs must differ in detail from previously patented designs, and should also offer both economic and engineering advantages.

Our review of those patents issued to Mr. A. C. Sanford revealed that his designs underwent a painstaking evolution, guided by fabrication and testing. Although we can benefit from all those designs previously patented, it is likely that a new design would require some redesign if optimum performance is required.

A letter proposal covering the Phase II work and cost estimate has been drawn up and dispatched to you via our contracting agency. We are looking forward to continuing this program for you.

Very truly yours,

J. M. Akridge
Project Director - A-1579

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